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Statement of Purpose

Charcot neuroarthropathy (CN) after surgical intervention has previously been described in the literature. While the pathophysiology of the condition is not well understood, it is largely believed that trauma, surgical or nonsurgical, is a sufficient trigger for the destructive inflammatory cascade, resulting in bone loss and deformity, placing patients at risk for wound formation, infection, and subsequent amputation. This report presents a unique case in which a neuroarthropathic process occurs following a Weil osteotomy. The Weil osteotomy, a distal oblique metatarsal neck osteotomy, is a surgical intervention for the treatment of metatarsalgia and metatarsophalangeal (MTP) joint dislocation by allowing for shortening of the targeted metatarsal. Due to the placement of the osteotomy perpendicular to the weight bearing surface, allowing for compression, the procedure is inherently stable. To the knowledge of the authors, this is the first case of CN following a popular procedure that is commonly used within the podiatric and orthopedic communities.

Literature Review

Charcot neuroarthropathy is a devastating complication in neuropathic diabetic patients. The condition is most commonly occurs in the midfoot and the ankle region²⁻⁴. The destruction and architectural failure typically occurs at the weakest part of the pedal kinetic chain, which explains the condition's disproportional predilection for the midfoot. While not common relative to the remainder of the foot, CN has been described in the forefoot region. Frykberg et al. demonstrated that 15%% of Charcot destruction was found in the metatarsal region². Interestingly, Schon et al. found a lower rate of forefoot CN, with 8% of 221 CN feet surveyed³. Similarly, Herbst et al. studied CN destruction in 55 cases and found a much lower incidence of CN in the forefoot at 3%.

Case Study



Figure 1. Pre-operative radiograph demonstrating 2nd MTPJ instability with 2nd digital deformity



Figure 2. Immediate post-operative radiograph demonstrating fixation and satisfactory alignment

A 59-year-old female with a 5-year history of type 2 diabetes mellitus (T2DM) presented to the Cleveland Clinic with a 13-month history of nontraumatic pain at the plantar aspect of the right 2nd MTP joint. Of note, aside from T2DM, the patient's medical history was significant for essential hypertension, irritable bowel syndrome, obstructive sleep apnea, and asthma; all were being treated without issue.

Upon physical examination, the 2nd MTP joint is dislocated with a corresponding dorsomedial overriding digital deformity and is painful on palpation plantarly. In addition, the dorsalis pedis and posterior tibial arterial pulses were palpable. Examination of protective sensation with a 5.07 gram Semmes Weinstein monofilament revealed loss of sensation, most noticeably to the level of the forefoot region. Plain film radiographs were ordered and further characterized the subluxation and digital deformity at the 2nd MTP joint (Figure 1). Due to presence of a painful hammertoe deformity and possibly plantar plate injury, surgery was discussed, which she eventually agreed to at the subsequent visit.

3 months later, patient eventually underwent right 2nd proximal interphalangeal (PIP) joint with a Weil osteotomy of the 2nd metatarsal. The 2nd MTP joint was exposed and the plantar plate was found to be intact and repair was not necessary. Next, a Weil osteotomy was performed, with 3 millimeters of shortening, and was fixated with a 2-0 solid stainless steel screw. Lastly, a 0.062 K-wire was advanced in a retrograde fashion through the phalanges after resection of the head of the proximal phalanx and base of the middle phalanx, and the incision site was closed with sutures (Figure 2).

Case Study Continued



Figure 3. 6-week postoperative radiograph revealing acute osseous destruction at the osteotomy site

Figure 4. 4.5-month postoperative radiograph revealing bone consolidation, suggesting a transition into the inactive phase

Figure 5. 6.5-month postoperative radiograph revealing significant remodeling, suggesting total transition into the inactive phase

Patient was seen postoperatively at post-operative days 5 and 13 and 28 and showed no signs of wound dehiscence, infection, satisfactory radiographic alignment, and patient denied any complaints of pain at those visits. Sutures and K-wires were removed on day 28 without incident and patient was instructed to continue wearing surgical shoe with instructions for limited weight bearing. Upon examination 6 weeks postoperatively, her skin temperature to the surgical foot was found to be unusually warm to touch. Cutaneous infrared thermography revealed a temperature difference of 4 degree Celsius relative to the contralateral joint. Immediate radiographs were ordered and revealed exuberant periosteal callus formation along the lateral margin of the distal 2nd metatarsal shaft at the level of the previous osteotomy site (Figure 3). Despite the lack of open wound and well-healed surgical incision, infection was considered but was ruled out and a diagnosis of CN was made based on thermographic, clinical, and radiographic presentations¹. Treatment consisted of immediate non-weight bearing to the afflicted foot.

3 months after the original onset of osseous Charcot changes and 4.5 months after the original surgery, radiographic evidence of consolidation, suggestive of transition into the inactive phase, had begun to occur and patient was given instructions to allow for partial weight bearing to the level of the forefoot (Figure 4). She was subsequently monitored for prominent hardware and any new increased changes that may be suggestive of an active process. The difference in temperature did not fall within 2 degrees Celsius of the contralateral joint until 5 months after the original onset and plain film radiographs confirmed consolidation and remodeling of osteotomy site (Figure 5).

At the 1-year point, the afflicted foot no longer demonstrated any inflammatory changes, the surgical incision had epithelialized, and no signs of infection or other issues were present. Patient has since progressed to full weight bearing, did not show any signs of prominent hardware that would necessitate removal, wound formation, and will continued to be monitored.

Discussion

In the present case, we present a case where Charcot has been localized to the level of the metatarsal and is secondary to surgical trauma. CN after surgery is an underreported post surgical complication, in so far, there have been 9 cases in the literature that describe the onset of Charcot neuroarthropathy shortly after orthopedic or podiatric intervention, elective and non-elective, and only 2 of the 9 documented cases were performed for reasons not related to limb salvage or for treatment of nonhealing ulceration like in the present case. Fishco et al. describes a case where CN occurred 8 weeks after an Austin bunionectomy was performed for the correction of hallux valgus⁹. Further, in 2014, Wunschel et al. presented a case in a 43-year old nondiabetic male who presents to clinic with CN after he had an arthrotomy with removal of dorsal osteophytes⁹. That patient subsequently developed ulceration due to the plantar bony prominences. To the knowledge of the authors, this is the first report that discusses the onset of CN after a Weil osteotomy. The effect of diabetes and neuropathy on bone metabolism is well documented and is considered a significant risk factor for poor outcomes in surgery¹⁰⁻¹⁴. The bone-nerve axis is believed to play a large role in bone healing, however, it is believed that dysregulation through years of hyperglycemia and altered bone metabolism, places patients at risk for osseous complications like CN. Unfortunately, clinicians are unable to effectively identify surgical patients who may at an increased risk for the development of CN after surgery, elective and non-elective, however, possessing a high index of post-operative suspicion is essential and can ultimately prevent adverse outcomes related to postoperative complications like CN.

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